CLAIMS

1. A method for manufacturing a semiconductor substrate characterized by comprising:

a mask forming step of forming a mask on a major surface of a single-crystal silicon substrate;

an ion implantation step of implanting oxygen ions to the major surface;

a surface protection layer forming step of forming a surface protection layer that blocks oxygen on the major surface;

a heat treatment step of forming a silicon dioxide layer in the single-crystal silicon by heat treatment; and

a removal step of removing the mask and the surface protection layer from the single-crystal silicon substrate.

2. The method for manufacturing a semiconductor substrate as claimed in claim 1, characterized in that the silicon dioxide layer has a pattern corresponding to presence/absence of the masks formed on the major surface and thickness of the mask.

3. The method for manufacturing a semiconductor substrate as claimed in claim 2, characterized in that the silicon dioxide layer has such a pattern that its distance from the major surface in an area where the mask has been formed is relatively short while its distance from the major surface in an area where the mask has not been formed is relatively long.

4. The method for manufacturing a semiconductor substrate as claimed in claim 1, characterized in that the mask is made of silicon dioxide.

5. The method for manufacturing a semiconductor substrate as claimed in

claim 4, characterized in that the mask forming step includes a step of forming a silicon oxide film with a desired thickness by thermally oxidizing the single-crystal silicon substrate, and a step of removing a part of the silicon oxide film by etching so that a mask of a desired pattern is formed on the major surface.

6. The method for manufacturing a semiconductor substrate as claimed in claim 4, characterized in that when the thickness of the mask is Y (nm) and acceleration energy in the ion implantation step is X (keV), a condition of $Y/X < 2$ is satisfied.

7. The method for manufacturing a semiconductor substrate as claimed in claim 1, characterized in that the step of forming the surface protection layer includes a step of forming a silicon dioxide layer on the major surface, and a step of forming a silicon nitride layer thinner than the silicon dioxide layer, on the silicon dioxide layer.

8. A semiconductor substrate manufactured by:

forming a mask on a major surface of a single-crystal silicon substrate;

implanting oxygen ions to the major surface;

forming a surface protection layer that blocks oxygen on the major surface;

forming a silicon dioxide layer in the single-crystal silicon by heat treatment; and

removing the mask and the surface protection layer from the single-crystal silicon substrate.

9. The semiconductor substrate as claimed in claim 8, characterized in that the silicon dioxide layer has a pattern corresponding to presence/absence of the

mask formed on the major surface and thickness of the mask.

10. The semiconductor substrate as claimed in claim 9, characterized in that the silicon dioxide layer has such a pattern that its distance from the major surface in an area where the mask has been formed is relatively short while its distance from the major surface in an area where the mask has not been formed is relatively long.

11. A method for manufacturing a semiconductor substrate characterized by comprising:

a mask forming step of forming a mask on a major surface of a single-crystal silicon substrate;

an ion implantation step of implanting oxygen ions to the major surface;

a surface protection layer forming step of forming a surface protection layer that blocks oxygen on the major surface;

a heat treatment step of forming a silicon dioxide layer in the single-crystal silicon by heat treatment;

a removal step of removing the mask and the surface protection layer; and

a polishing step of polishing the major surface by a predetermined quantity;

wherein the silicon dioxide layer has such a pattern that its distance from the major surface in an area where the mask has been formed on the major surface is relatively short while its distance from the major surface in an area where the mask has not been formed is relatively long, and

the quantity of polishing at the polishing step is equal to the quantity of removal of the silicon dioxide layer formed in the area where the mask has been formed.

12. The method for manufacturing a semiconductor substrate as claimed in claim 11, characterized in that the quantity of polishing at the polishing step is such a quantity that the silicon dioxide layer formed in the area where the mask has not been formed is not reached.

13. The method for manufacturing a semiconductor substrate as claimed in claim 11, characterized by further comprising a step of forming single-crystal silicon on the major surface after polishing the major surface.

14. The method for manufacturing a semiconductor substrate as claimed in claim 11, characterized in that the mask is made of silicon dioxide.

15. The method for manufacturing a semiconductor substrate as claimed in claim 14, characterized in that the mask forming step includes a step of a step of forming a silicon oxide film with a desired thickness by thermally oxidizing the single-crystal silicon substrate, and a step of removing a part of the silicon oxide film by etching so that a mask of a desired pattern is formed on the major surface.

16. The method for manufacturing a semiconductor substrate as claimed in claim 14, characterized in that when the thickness of the mask is Y (nm) and acceleration energy in the ion implantation step is X (keV), a condition of $Y/X < 2$ is satisfied.

17. The method for manufacturing a semiconductor substrate as claimed in claim 11, characterized in that the surface protection layer forming step includes a step of forming a silicon dioxide layer on the major surface, and a step of forming a silicon nitride layer thinner than the silicon dioxide layer, on the silicon dioxide layer.

18. A semiconductor substrate manufactured by:

forming a mask on a major surface of a single-crystal silicon substrate;

implanting oxygen ions to the major surface;

forming a surface protection layer that blocks oxygen on the major surface;

forming a silicon dioxide layer in the single-crystal silicon by heat treatment;

removing the mask and the surface protection layer; and

polishing the major surface by a predetermined quantity;

wherein the silicon dioxide layer has such a pattern that its distance from the major surface in an area where the mask has been formed on the major surface is relatively short while its distance from the major surface in an area where the mask has not been formed is relatively long, and

the quantity of polishing at the polishing step is equal to the quantity of removal of the silicon dioxide layer formed in the area where the mask has been formed.

19. The semiconductor substrate as claimed in claim 18, characterized in that the quantity of polishing is such a quantity that the silicon dioxide layer formed in the area where the mask has not been formed is not reached.

20. The semiconductor substrate as claimed in claim 18, characterized in that the semiconductor substrate is manufactured by forming single-crystal silicon on the major surface after polishing the major surface.